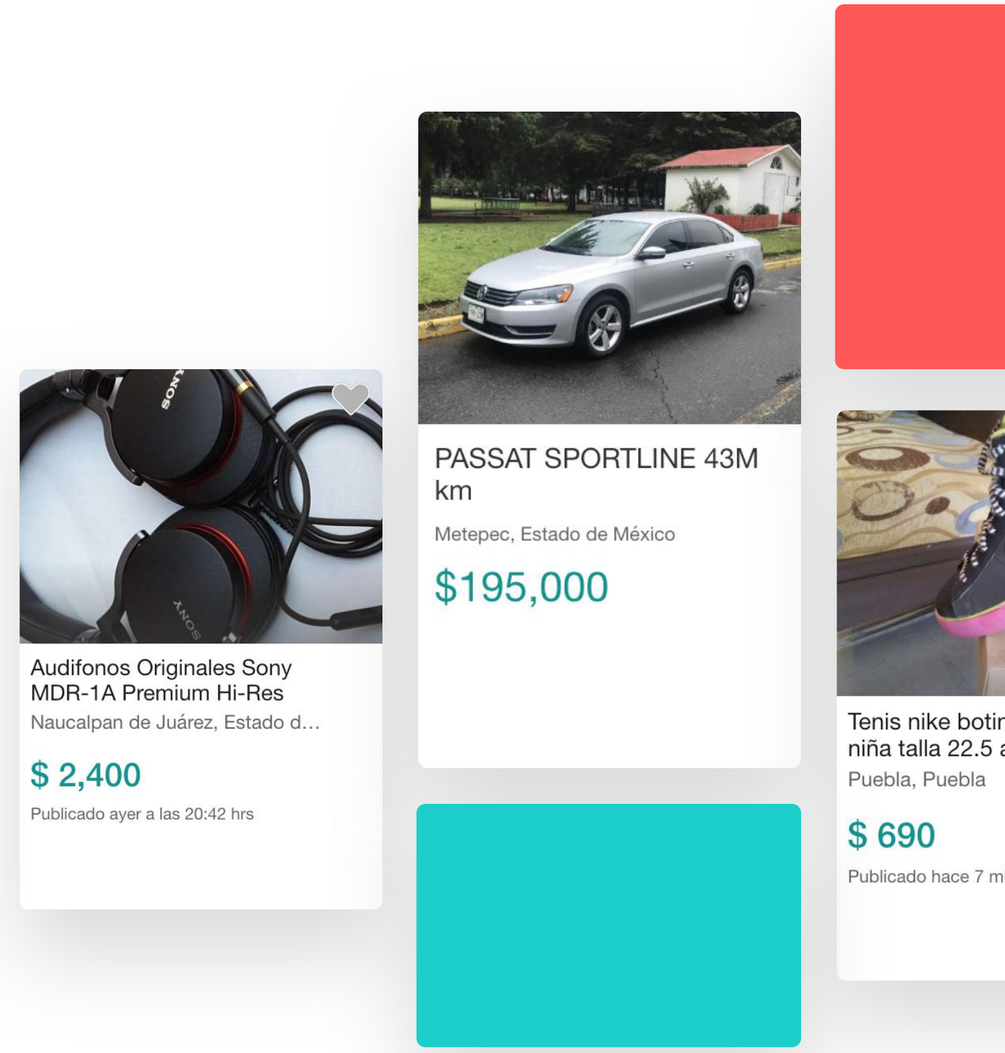
Recombee

segundamano



Segundamano's Success Story with Recombee

Bringing Personalization to 160 Million Monthly Pageviews

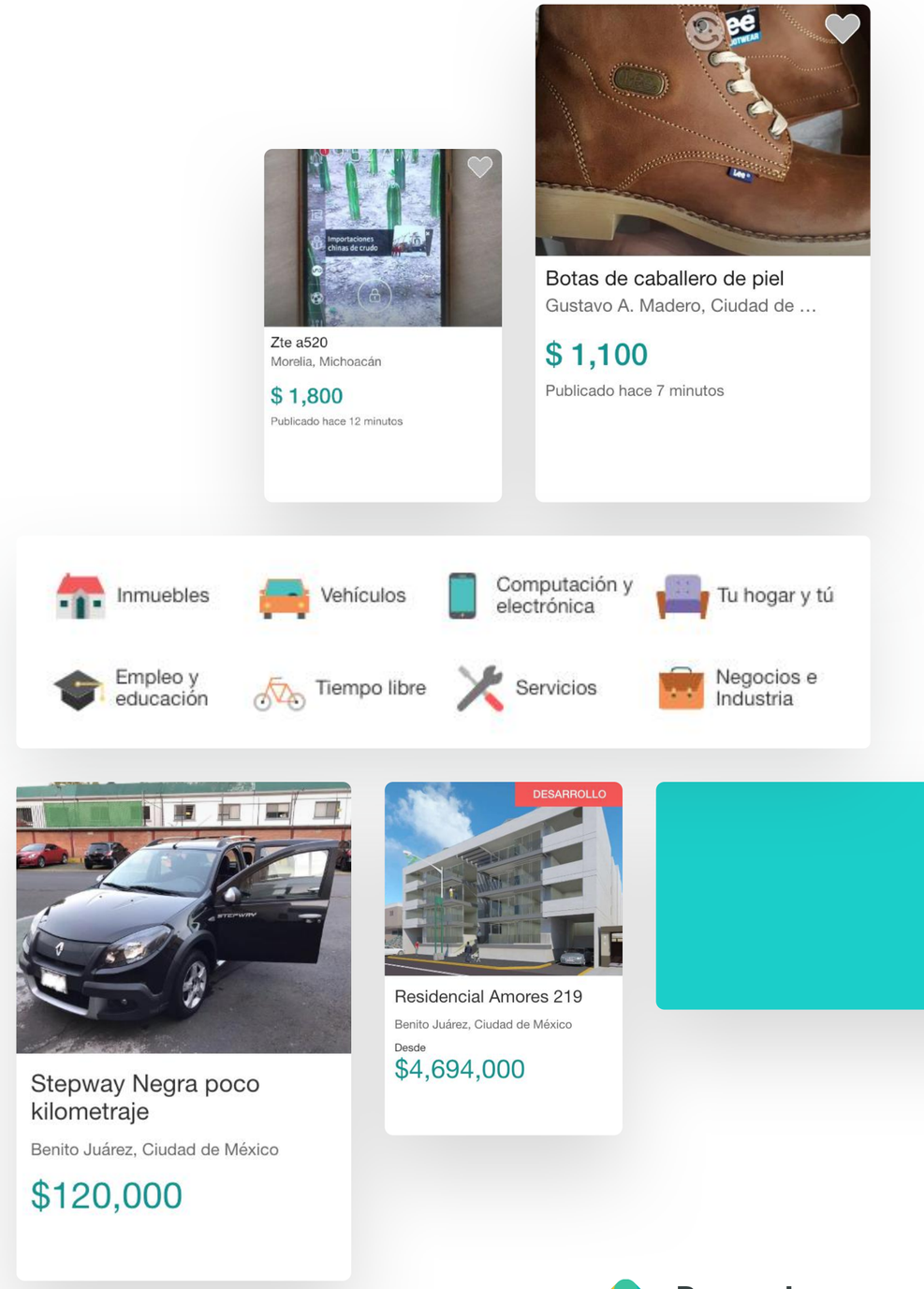
Online Portal Ads

Recombee & Segundamano Partnership
Navigating a high-traffic website complexity

Segundamano is a leading online marketplace offering exceptional product diversity. They are known for their focus on technology and innovation as well as customer experience.

The high level of traffic on Segundamano's website was a challenge for the company. Due to the number of items available, and the constantly changing content, it was not practical to manually browse and manage each and every recommendation given to consumers.

Contributing to the management of the high complexity of Segundamano's website, Recombee provided a high-tech recommender engine solution, built on collaborative filtering-based models, leading to 3 times more conversions.

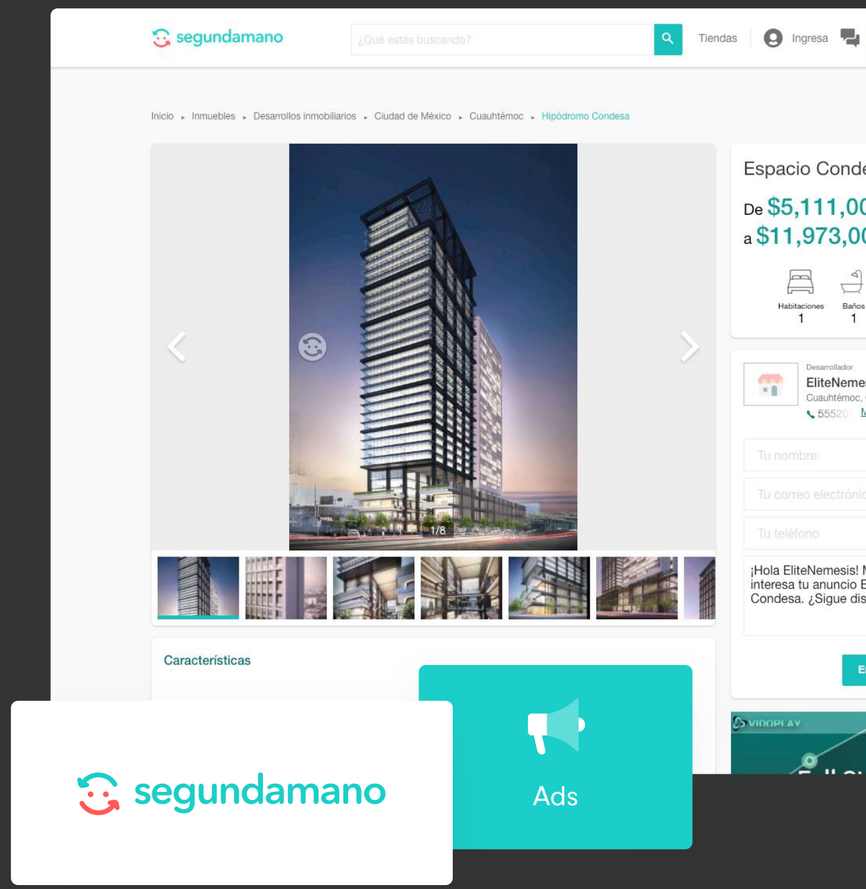


Recombee

Segundamano: One of the largest online classifieds ads portals

Segundamano is the largest online classifieds ads platforms in Mexico. With its business model similar to Craigslist in the US, Segundamano seeks to be the best meeting point between sellers and buyers allowing them to create mutually beneficial relationships.

Segundamano's platform offers an array of products such as furniture, electronics, and clothing, as well as real estate ads and job offers. The online marketplace belongs to Adevinta, a Norwegian multinational company that is one of the most ambitious technology and product companies in Europe, serving more than 250 million users worldwide.



Focus on KPIs and business strategy through AI

Segundamano's number one priority is to recognize preferences of individual users in order to balance personalization and discovery of new products. Due to the highly heterogeneous nature of individual products, the previously used simple solution based on metadata did not sufficiently provide visitors with relevant product recommendations.

Segundamano required that Recombee's recommender engine navigated their site's complexity and recognized preferences of individual users within the vast group of consumers. The other objective was to balance personalization and discovery of newly added products. The requirements were highly Providing real-time recommendations while processing extra-large traffic.

Recombee's solution focused on Segundamano's KPIs, while serving the following requirements:

- Recognize preferences of individual users.
- Balance personalization and discovery of products.
- Find similar products.
- Real-time response in large traffic.

Solution 1/2

State-of-the-art algorithm ensemble to reflect Segundamano's challenges

Recombee brought a solution to all of Segundamano's requirements. It's collaborative-filtering based models were able to outperform metadata-based ones.

For long-tail or new items with not enough interactions, deep learning image models are able to determine similar items. Our high-quality recommendations for the entire product catalog were generated through a combination of collaborative-filtering and robust text-mining models.

$$score(u,i) = r_m + \mathbf{q}_{*,i}^T \cdot \mathbf{p}_{*,u}$$

$$\begin{aligned} &\text{model}(u) = \{i_1, \dots i_N\} \\ &\forall i_k \in \text{model}(u): \quad i_k \in I \wedge \\ &\qquad |\{j \in I \setminus \{i_k\} \mid score(u,j) > score(u,i_k)\}| < N \end{aligned}$$

$$score(u,i) = \begin{cases} \sum\limits_{\substack{(X \Rightarrow Y) \in \mathcal{R} \\ T(u) \subseteq X \\ i \in Y}} q\,(X \Rightarrow Y) & \text{if } \exists\,(X \Rightarrow Y) \in \mathcal{R}\colon X \subseteq T(u) \wedge i \in Y \\ 0 & \text{otherwise} \end{cases}$$

$$score(u,i) = \left(h\left(\mathbf{W} \cdot g\left(\mathbf{V} \cdot \hat{\mathbf{r}}_{*,i} + \boldsymbol{\mu}\right) + \mathbf{b}\right)\right)_u$$

$$\begin{aligned} &\text{NN}_k(u) = \{v_1, \dots, v_k\} \\ &\forall v \in \text{NN}_k(u): \quad v \in U \setminus \{u\} \wedge \\ &\qquad |w \in U \setminus \{u\} \mid sim(u,w) > sim(u,v)| < k \end{aligned}$$

$$\min_{\substack{\mathbf{P} \in \mathbb{R}^{f \times U} \\ \mathbf{Q} \in \mathbb{R}^{f \times I}}} \sum_{\substack{u \in U \\ i \in I}} \left(c_{u,i} \cdot \left(y_{u,i} - \mathbf{q}_{*,i}^T \cdot \mathbf{p}_{*,u}\right)^2\right) + \lambda \left(\sum_{u \in U} \|\mathbf{p}_{*,u}\|^2 + \sum_{i \in I} \|\mathbf{q}_{*,i}\|^2\right)$$

$$\mathbf{p}_u = \left(\mathbf{Q} \cdot \mathbf{C}^u \cdot \mathbf{Q}^T + \lambda \mathbf{I}\right)^{-1} \cdot \mathbf{Q} \cdot \mathbf{C}^u \cdot \mathbf{y}_{u,*}^T$$

$$score(u,i) = \begin{cases} \sum\limits_{\substack{v \in \text{NN}_k(u) \\ r_{v,i} \neq ?}} sim(u,v) \cdot r_{v,i} & \text{if } \exists v \in \text{NN}_k(u)\colon r_{v,i} \neq ? \\ 0 & \text{otherwise} \end{cases}$$

$$score^{\beta}_{\text{PS}}(u,i) = \begin{cases} \dfrac{score(u,i)}{|\{v \in U \mid r_{v,i} > 0\}|^{\beta}} & \text{if } \exists v \in U\colon r_{v,i} > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\min_{\substack{\mathbf{V} \in \mathbb{R}^{f \times |U|} \\ \mathbf{W} \in \mathbb{R}^{|U| \times f} \\ \boldsymbol{\mu} \in \mathbb{R}^{f} \\ \mathbf{b} \in \mathbb{R}^{|U|}}} \sum_{\substack{u \in U \\ i \in I \\ r_{u,i} \neq ?}} \left(r_{u,i} - \left(h\left(\mathbf{W} \cdot g\left(\mathbf{V} \cdot \hat{\mathbf{r}}_{*,i} + \boldsymbol{\mu}\right) + \mathbf{b}\right)\right)_u\right)^2 + \frac{\lambda}{2} \cdot \left(\|\mathbf{V}\|^2 + \|\mathbf{W}\|^2\right)$$

$$sim(u,v) = \frac{\mathbf{r}_{u,*} \cdot \mathbf{r}_{v,*}^T}{\|\mathbf{r}_{u,*}\| \cdot \|\mathbf{r}_{v,*}\|} = \frac{\sum\limits_{\substack{i \in I \\ r_{u,i} \neq ? \\ r_{v,i} \neq ?}} r_{u,i} \cdot r_{v,i}}{\sqrt{\sum\limits_{\substack{i \in I \\ r_{u,i} \neq ?}} r_{u,i}^2} \cdot \sqrt{\sum\limits_{\substack{i \in I \\ r_{v,i} \neq ?}} r_{v,i}^2}}$$

$$\mathbf{q}_i = \left(\mathbf{P} \cdot \mathbf{C}^i \cdot \mathbf{P}^T + \lambda \mathbf{I}\right)^{-1} \cdot \mathbf{P} \cdot \mathbf{C}^i \cdot \mathbf{y}_{*,i}$$

$$recall@N_{\text{LOO}}\left(m, \mathcal{T}_{\text{val}}\right) = \frac{|\{(u,i) \mid (u, r^+(u)) \in \mathcal{T}_{\text{val}} \wedge i \in r^+(u) \wedge i \in m\left(u, r^+(u) \setminus \{i\}\right)\}|}{|\{(u,i) \mid (u, r^+(u)) \in \mathcal{T}_{\text{val}} \wedge i \in r^+(u)\}|}$$

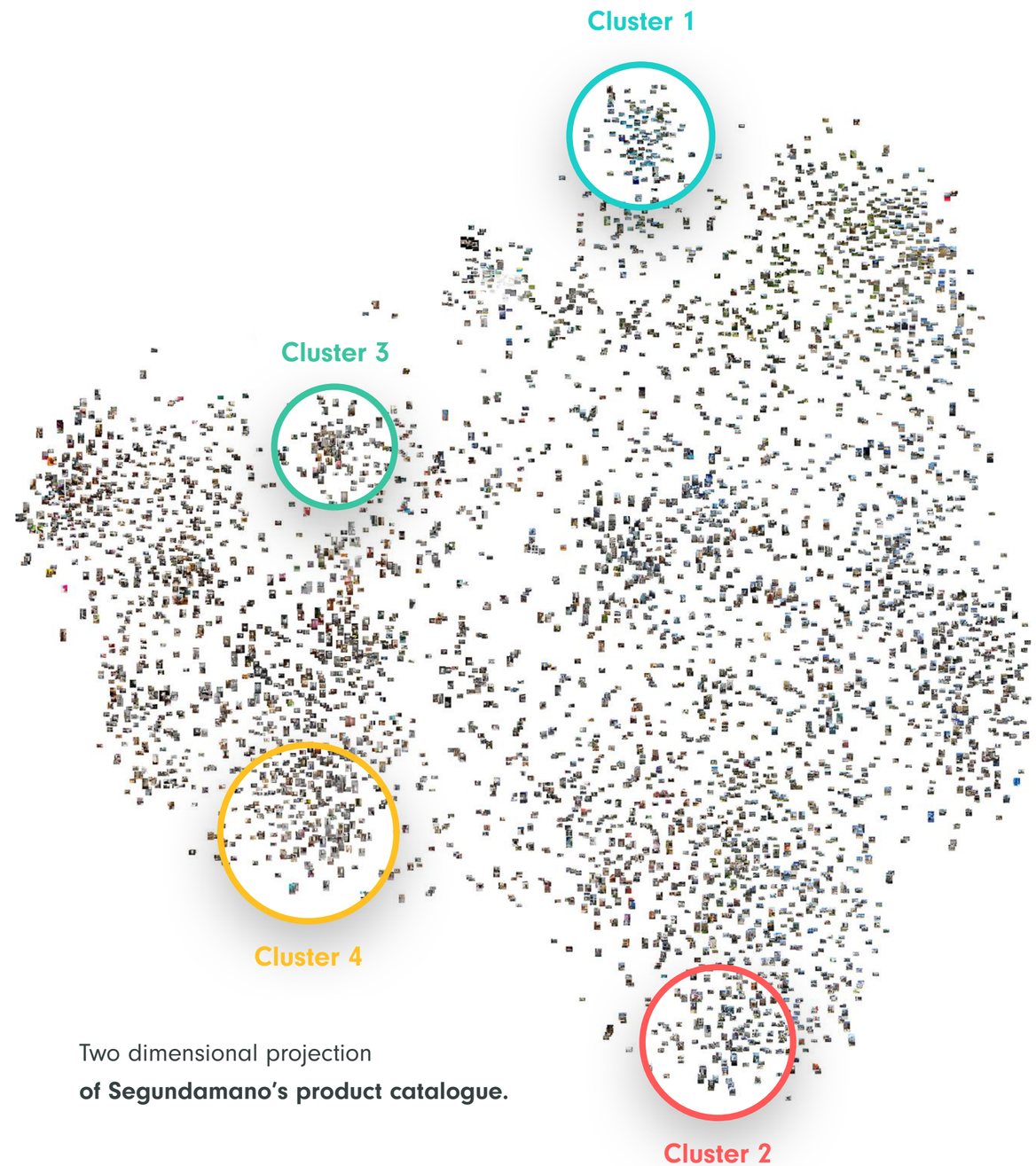
Example of **advanced algorithm model ensemble** by Recombee.

The image processing algorithms in action

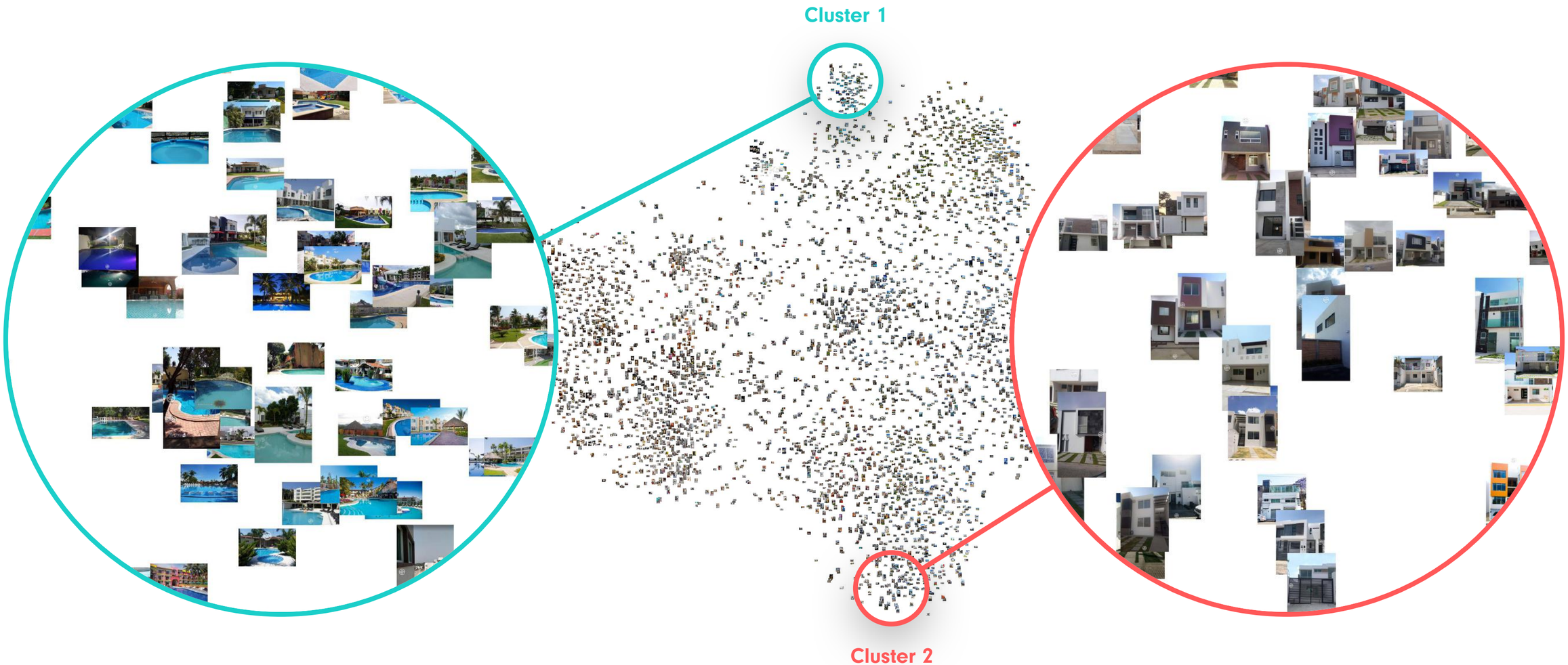
When shopping online, visual information, such as product image, plays an important role in customer decision making. Our solution for Segundamano included a wide variety of advanced algorithms with the addition of our image processing models in order to significantly improve the precision of recommendations.

Image processing algorithms:

- tackle inaccurate or incomplete text descriptions,
- improve cold start recommendations
- enhance precision of recommendations



Two dimensional projection
of Segundamano's product catalogue.



The detailed view shows **image clustering based solely on visual similarity.**

Solution 2/2

Recombee's solution was customized to fit a variety of requirements

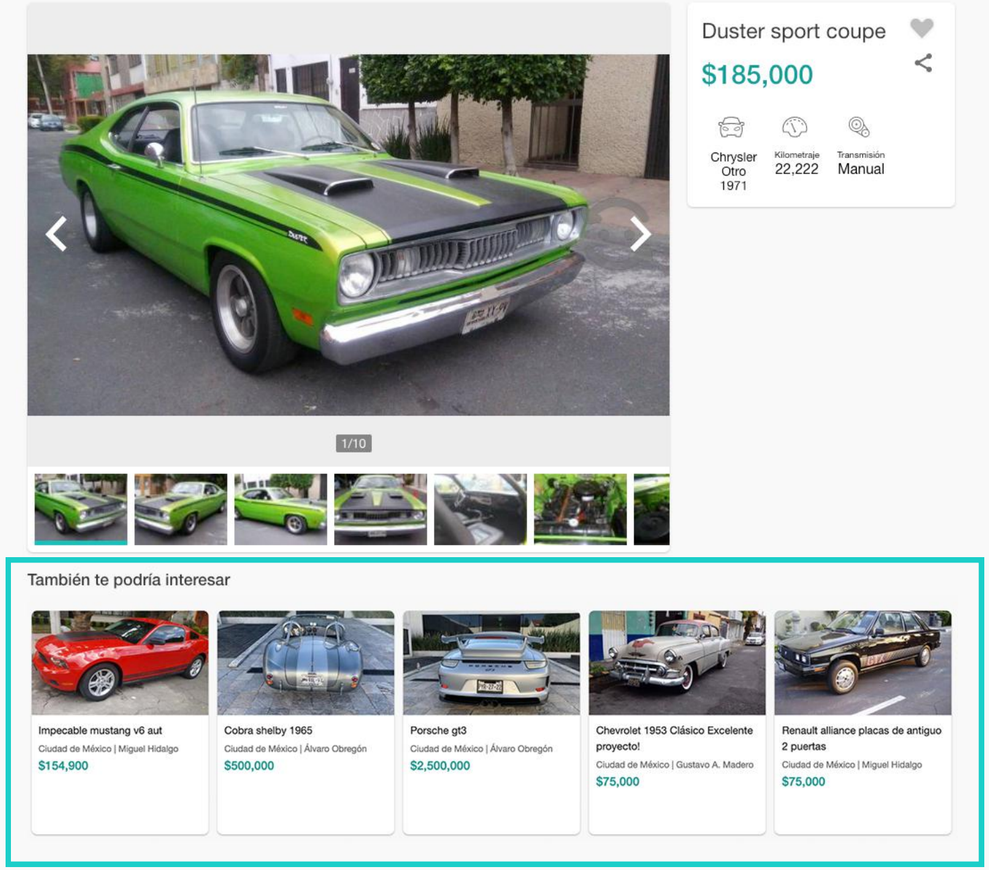
- Real-time model updates and recommendations under 100 ms
- Optimizing an ensemble of collaborative filtering, text-processing and image-based deep learning
- Processing pipeline of 10M+ product images: downloading, processing on GPU, updating visual-similarity based models in near-real time
- Scaling on large computational infrastructure (100s of CPUs, several TBs or RAM) to achieve high performance without compromising quality
- Advanced processing of Spanish text titles and descriptions
- Automated fine-tuning of category-dependent model ensemble hyper-parametrization to maximize CTR

Scenario Example

También te podría interesar (you may also like)

The product detail view recommendations take into consideration similar user interactions, purchase history, and different product attributes enhanced by image processing capabilities of Recombee's solution.

This scenario's main goal is to show users relevant content while showing users similar products to widen their shopping options.



Results

3x More Conversions
4x More Interactions
10% Item Views Attributed to a Recommendation Made by Recombee

- **4,000,000** Products
- **+160,000,000** recommendation requests /month
- **Automatic** personalized recommendations applied to product view
- **Model with real-time updates** for every single user

Recombee

Client satisfaction is our top priority

"Our developers love Recombee documentation as well as quick and valuable technical support. We see Recombee's "recommendationsToUser" algorithm as a great option to start offering a personalized experience in our site."

Marco Alvarez Product Manager at Segundamano

Recombee

"Why waste time and money on the development of your own recommender system, if you can use the most advanced engine tailored by data scientists."

Excellent **scalability, big data infrastructure**

Universal SaaS solution verified on **multiple verticals**

Real time machine learning

Simple and intuitive API + **SKDs** for easy integration

Research and improvements on sophisticated algorithms and AI

Graphical user interface for monitoring KPIs

Recombee

For more info contact

business@recombee.com